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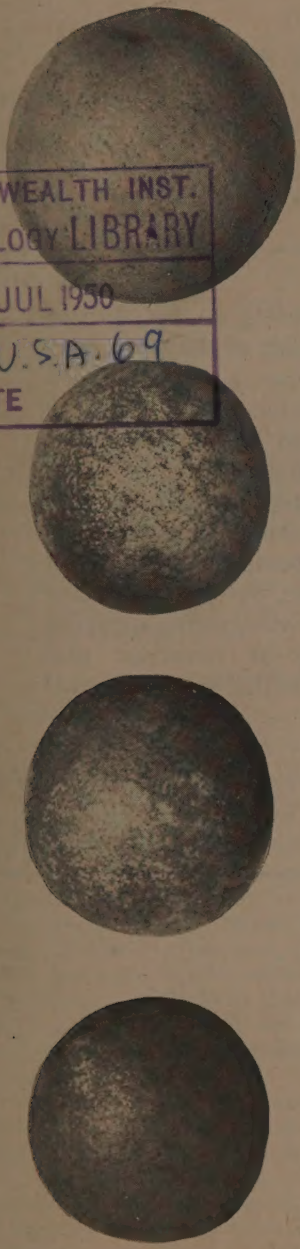

Citrus Rust Mite

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THE CITRUS RUST MITE, feeding on the skin of citrus fruit, reduces the size of the fruit, may lower its quality, and causes a skin blemish known as russeting. Russeted fruits sell at a discount on the market, and losses to growers total millions of dollars each year.

To prevent russeting, growers should dust citrus trees with sulfur according to a schedule that will give year-round protection. A spray program utilizing lime-sulfur, wettable sulfur, or both may be used by those who prefer spraying to dusting. Thoroughness of coverage and promptness in spraying or dusting as soon as rust mites appear are essential.

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CONTROL OF THE CITRUS RUST MITE

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RUSSETING is a blemish on the skins of oranges, grapefruits (fig. 1), tangerines, satsumas, and other citrus fruits caused by the citrus rust mite.[1] This mite is one of the most common and serious pests of citrus in Florida and the other Gulf Coast States, and is sometimes found in certain citrus districts in California. Russeting lowers the weight, size, appearance, and grade of the fruit, and makes it less attractive to buyers. Losses to citrus growers from russeting total several million dollars every year. Russeting can be prevented by controlling the rust mite.

DESCRIPTION OF RUSSETING

The feeding of thousands of citrus rust mites on the skin of citrus fruit causes a light-brownish to blackish discoloration, or russeting. The mites puncture the skin, and then oil from the skin exudes, spreads over the surface, and scalds it. Scar tissue appears on such scalded spots, and no treatment will prevent or remove the russeting scars. Feeding by the mites also reduces the juice content of the fruits.

The extent of this russeting depends on the number of mites present and the length of time they feed. If no rust mites are present throughout the year, "bright" fruits, with no trace of russeting, will be produced. A small infestation, if promptly treated and eradicated, will usually leave traces of russeting, which reduce the grade of the fruit to "golden." A slightly larger infestation, or a small one not so promptly eliminated, will result in "bronze" fruits. Heavier infestations, unchecked, will produce fruits graded "russets" or "black russets" in a short time.

The russeting scars may not cover the entire skin, but may appear in spots, blotches, or bands, leaving uninjured spaces standing out in contrast. Sometimes grapefruits also show bands similar to "tear stain," radiating down from the stem ends. When the russeting is so severe that the entire skin becomes dry, cracked, and scaly, the fruit may be graded as "sharkskin."

[1] *Phyllocoptruta oleivora* (Ashm.).

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The rust mites also feed on the leaves of citrus. Heavily infested leaves lose their gloss and dark-green color and fall to the ground prematurely. Infestations often develop on the leaves just before the trees begin to bloom, and as soon as the young fruits set, the mites migrate to them and scar them severely. Any weakening of the trees or its leaves from heavy infestations of rust mites may increase the damage to the tree from cold.

Figure 1.—Grapefruit injured by russeting.

LOSSES CAUSED BY RUSSETING

Losses from russeting amount to millions of dollars every year. In 1945–47 losses from lower grading and lower sales prices of the russeted fruit amounted to at least 4 million dollars a year. In addition to the market losses, russeting also causes heavy production losses. Good pickers usually throw heavily russeted small fruits to the ground, and the larger russeted fruits that reach packing houses are sent to the canners or to the cull piles. It is impossible to place a money value on this production loss.

Although losses of grapefruit per grove are heavy in the Gulf States, losses per packed box of grapefruit are less than per box of oranges. The difference in selling price between bright and russeted grapefruits is not so great as with oranges, and the volume of bright western grapefruit is not large enough to afford such keen competition for the russeted grapefruits. However, the damage to appear-

ance from russeting is important to grapefruit growers, because a buyer usually selects a bright grapefruit in preference to a russeted fruit of equal size and weight.

THE CITRUS RUST MITE—ITS APPEARANCE AND LIFE HISTORY

Citrus rust mites are so small that full-grown ones can barely be seen with the unaided eye. A hand lens, such as a linen tester that magnifies 5 to 15 times, shows the mites to be lemon-yellow, maggot-shaped, broad and round at the head end, and tapering to a blunt point at the tail. The mites can be seen more easily on green leaves or green fruits than on fruits already colored.

The mites lay tiny eggs, singly or in groups, in the depressions of the fruit skin or on the leaves. These eggs hatch, within 2 to 4 days in summer and 4 to 8 days in winter, into young that resemble the adults in shape and color. They develop and mature very rapidly—in only 7 to 10 days in summer.

All citrus rust mites are females, capable of laying eggs. Males have never been seen. With favorable weather a light infestation can develop into a heavy, damaging one in a very short time. The mites can be found on citrus trees throughout the year, but are somewhat less abundant in winter and in July and the early part of August.

CONTROL WITH SULFUR

Sulfur can be used for controlling the rust mite. Excellent control may be obtained by dusting trees with dusting sulfur, or by spraying them with dry or liquid lime-sulfur, wettable sulfur, or combinations of these spray materials.

Each material has its advantages. Sulfur dust is cheap, and machinery for dusting costs less than machinery for spraying. However, dusts are washed away by rains more quickly than sprays, and more applications a year are necessary. Even so, a yearly dusting program is less expensive than a spray program and is more suitable for small groves. Liquid lime-sulfur stays on the trees and fruits longest, followed in order by dry lime-sulfur, wettable sulfur, and sulfur dust. Satisfactory protection against rust mites is afforded by a spray of lime-sulfur plus wettable sulfur. A grower may change at will from spraying to dusting, and from dusting to spraying.

Lime-sulfur is more likely to cause spray burn in hot summer weather. Sulfur dusts or wettable-sulfur sprays are safer, especially on tender varieties, such as Hamlin oranges. In winter and spring tangerines are susceptible to spray burn from lime-sulfur; hence, for them sulfur dust or wettable sulfur spray is better.

Trees under a spray program occasionally become infested and require treatment shortly before picking time. In such cases sulfur dust may be used, as large acreages can be covered quickly.

If oil sprays have to be used for control of scale insects, whiteflies, or citrus red mites (purple mites),[2] 4 weeks should elapse between the sulfur dust or spray and the oil spray, and between the oil spray and the next application of sulfur, to avoid spray injury to the trees.

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[2] *Paratetranychus citri* (McG.).

Caution.—Many of the chemicals used for insect control are poisonous to man or irritating to the respiratory tract. Persons unskilled in handling these substances should obtain the advice or supervision of experts. Sulfur dust is irritating to the eyes, nose, and throat. Undiluted lime-sulfur may also burn the skin. After applying the dust wash the face and hands with soap and water and change your clothing. If eye irritation persists for more than an hour, a drop or two of eye lotion or sweet cream in each eye will give relief. Never rub the irritated eyes, especially if your hands are covered with sulfur dust or spray. It may sometimes be desirable to wear goggles to protect the eyes, or to use a respirator to avoid breathing the dust.

Applying Sulfur Dusts

Dusting sulfur is lump sulfur that has been ground with talc or other diluent until the dust particles will pass through a 325-mesh sieve. Many brands now have a sulfur content of 90 percent or more. In general, the higher the sulfur content, the better it is for use on citrus, provided the dust will store well and blow well from the machine. Sulfur dusts are available with particle size much smaller than 325 mesh, but they have not given better control and may be somewhat more expensive.

For adequate coverage of mature orange or grapefruit trees in the main Citrus Belt, 1 pound of sulfur dust for each application is necessary. Young trees require less, and very large trees, such as old seedlings, may require 1½ to 2 pounds. The grower with only a few dozen trees will find a rotary hand duster holding about 20 pounds of dusting sulfur is satisfactory (fig. 2). For larger groves a blower run by a

Figure 2.—Rotary hand duster for use in dusting a few trees.

gasoline engine is the usual equipment (fig. 3). It may be mounted on its own wheels or on skids to be used in a light truck. Very large groves may be dusted by airplane.

The number of applications a year will vary with the rainfall, but will seldom be less than three or four in dry seasons. In 1946 the cost of sulfur dust for mature trees receiving six dustings was only about 17 cents a tree for the year.

Figure 3.—Multiple-outlet power dusting machine.

DUSTING SCHEDULE

Application	*Approximate time*
Dormant	Before first flush of growth.
Postbloom	Mar. 20 to Apr. 15.
Early summer	May 10 to June 10.
Late summer	Aug. 1 to 15.
Fall	September to October.
Winter	October to December.

It is a mistake to stop dusting the trees after the fruit has been picked. The dormant application eliminates the mites on the old leaves and prevents them from migrating to new spring growth, to bloom, and to fruits as they set. The postbloom treatment covers the leaves that have appeared after the first dusting, and puts a protective coating on the young fruits. The early-summer dusting may be omitted sometimes, but not if rust mites appear. The late-summer dusting is very important. It protects fruit and summer growth from increases in mite infestations, which take place about the middle of August. Weekly examinations for rust mites will indicate whether one application will suffice, in place of the separate fall and winter dustings in the schedule.

The time for dusting is flexible and can vary with the season, the weather, and the degree of infestation. In general, the protective deposit of sulfur should be renewed as soon as any rust mites can be

found. Examining the leaves and fruits every week with a hand lens for the first appearance of mites and dusting as soon as any are found make for the most economical control. Sulfur dust adheres better when dew is on the trees, but midday applications are also satisfactory unless a hard rain follows on the same day and washes the dust off. In dry periods the interval between treatments can be greatly prolonged. By taking advantage of such circumstances and of the flexibility of the dusting schedule, the grower may be able to reduce the number of dustings necessary during the year.

Some growers time their dustings on the first appearance of russeting on the fruits, rather than on first appearance of the rust mites. They do not understand that russeting scars develop slowly and that, in order to have the best fruit, they must prevent the mites from feeding.

Applying Sulfur Sprays

SPRAY SCHEDULE

Time	*Materials (quantity per 100 gallons)*	
	Regular Program	*Alternate Combinations*
	DORMANT	
Before first flush of growth.	Lime-sulfur 2 gallons plus wettable sulfur 5 pounds.	Neutral copper compound [1] plus wettable sulfur 10 pounds for scab and mites.
	POSTBLOOM	
2 or 3 weeks after blooms have shed.	Lime-sulfur 2 gallons plus wettable sulfur 5 pounds.	Neutral copper compound [1] plus wettable sulfur 10 pounds.
	EARLY SUMMER	
When protection from previous spray diminishes and rust mites reappear on leaves and fruits.	Lime-sulfur 2 gallons plus wettable sulfur 5 pounds.	Wettable sulfur 5 or 10 pounds or sulfur dust.
	MIDSUMMER	
June 1 to July 15	----------	Spray containing 1.3 percent of oil for scales, if needed.
	LATE SUMMER	
About Aug. 15, when mites reappear.	Lime-sulfur 1 gallon plus wettable sulfur 10 pounds.	Wettable sulfur 10 pounds, or sulfur dust.
	FALL—WINTER	
October to December, whenever mites reappear.	Lime-sulfur 2 gallons plus wettable sulfur 10 pounds.	Wettable sulfur 5 to 10 pounds.

[1] Use as directed by the manufacturer.

Either wettable sulfur or lime-sulfur may be used in sprays to control the rust mite on citrus. Wettable sulfur is a finely ground (325-mesh) lump sulfur mixed with a diluent and a wetting agent and sometimes with an adhesive. Wettable sulfur is often used with either lime-sulfur or a neutral copper fungicide. (See caution statement, p. 4.) It adheres better when used with lime-sulfur. The copper-sulfur combination provides for the control of melanose and scab as well as the rust mites. Lime-sulfur is a complex mixture of calcium and sulfur compounds, and is available in either liquid or dry form. The liquid remains on the trees longer than the dry product. Lime-

Figure 4.—Power sprayer mounted on a truck.

sulfur should not be used with copper. Three pounds of dry lime-sulfur may be substituted for each gallon of liquid lime-sulfur.

The scheduled spray treatments may be advanced or delayed to coincide with the first appearance of the rust mites. The alternative combinations are preferred when it is necessary to control melanose or scab in addition to rust mites, or when a safer spray combination is needed, as in early- or later-summer applications.

Hand sprayers and barrel spray outfits are too small for making spray applications to citrus trees. Growers with too few trees to justify the purchase or rental of a power spray outfit should use dusts.

The power sprayer with two or more cylinders should provide pressure at the pump of 200 to 600 pounds per square inch with all spray guns open (fig. 4). The pressure of the spray should be sufficient to flutter the leaves so that both sides of every leaf will be covered quickly, but not strong enough to tear the leaves or injure the fruit. Four